~~CONFIDENTIAL~~
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September 18, 1956

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SUBJECT: Contract RD-94
Task Order No. 2

25X1

In accordance with Article 2 of the basic contract, there are forwarded herewith two (2) copies of the Monthly Progress Report for August, 1956 on Task Order No. 2 of RD-94. The report is dated September 6, 1956. This report is UNCLASSIFIED. An additional copy is being held in [redacted] by the project engineer for the use of your personnel while at this location. 25X1

In connection with this monthly progress report, the following information is submitted:

Total expenditures to 7-31-56	$ 2,368
Outstanding commitments as of 7-31-56	None
Funds remaining as of 7-31-56	$57,948

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Very truly yours,

25X1

Assistant Manager
Government Contract Administration

TER:val
C-14606
Enclosures cc: [redacted] 25X1

w/encl.

C-740

~~SECRET~~ ~~CONFIDENTIAL~~

P-185

MONTHLY PROGRESS REPORT

August 1956

Task Order No. 2
Contract No. RD-94

AUDIO NOISE REDUCTION CIRCUITS

The object of this project is to develop a noise reduction circuit suitable for use in separating speech intelligence from a signal containing speech and noise when the speech intelligence is masked by the noise. The proposed method consists of passing the signal through several frequency selective channels. Each channel contains a non-linear element which discriminates against the noise when the speech information in the channel is greater than the noise.

During August the construction of a four channel noise reduction circuit has been completed. The circuit is arranged so that the signal in each channel may be passed through directly, or it may be passed through a non-linear element whose threshold is adjustable. Circuit adjustments have been completed so that the four channel system performs satisfactorily.

Using the four channels, without the non-linear element feature, experiments have been performed aimed at ascertaining the most desirable bandwidths and band spacings required to give adequate noise reduction.

First, listening tests were made with various speech samples mixed with white noise. The samples were passed through several different combinations of bandpass filters. In each case studied it was found that a wide band system gave the greatest intelligibility for a given signal to white noise ratio.

Second, listening tests were performed to determine the masking effect of noise not in the speech pass band. In this experiment the speech was contained in a noise free band between 700 and 3500 cps. Noise was then introduced outside this band. First, through a low pass filter from 0 to 700 cps, then through a high pass filter from 3500 to above 10,000 cps, and finally, through these two filters in combination. It was found that the noise power could be raised from 14 to 27 db above the maximum speech power before intelligence was considerably reduced. The relative levels were measured on a root mean square level recorder, and also on an oscilloscope. Next, noise was introduced in the speech band. For this case the noise power level had to be reduced 4 db below

the speech level for good intelligibility. For wide band signals, good intelligence is obtained when the noise and speech levels are about equal.

Third, a limited number of selected words were chosen which have relatively flat formants; i.e., formants whose frequencies are constant. These words were analyzed on a sound spectrograph, and the frequency regions of maximum energy were obtained. These speech samples were then passed through a set of three bandpass filters which passed the frequencies of maximum speech energy. Subjective listening tests were carried on to determine the value of this type of noise discrimination. No conclusive results were obtained from this experiment. It appears that subjective listening tests will not provide a satisfactory criterion when the tests are made on narrow band information. Some type of objective measurement must be devised which will give a more definite result.

As yet, no definite conclusion on bandwidth or band spacing have been reached.

ESR:nan

September 6, 1956